

TITLE OF THE PROPOSED RESEARCH WORK:

“Adaptation and mitigation of climate change effects on T-aman farming system in Patuakhali: a soil nutrient aspect for food security”

SIGNIFICANCE OF THE PROPOSED RESEARCH:

The coastal regions have mean elevations ranging from 1–4 metres above mean sea level (MSL) (Rashid, 1978). Temperature is increasing day by day for the effect of greenhouse gas emissions. The low elevations and temperature increasing make the country exceptionally vulnerable to sea level rise, saline intrusion and other impact of future climate change (Karim and Mimura, 2008). They also affect on soil and water quality for agricultural and other uses. For the majority of the coastal population, the growth and sustainability of the agricultural sector is of paramount importance to their own prosperity and survival, and to a large extent this is also true for the national economy. Therefore, any changes due to climate variability will have profound socio-economic implications and food security issues (Thurlow *et al.*, 2012). The coastal regions cover 2.85 Mha, of which 0.83 Mha are arable. This represents some 30% of the cultivable lands of Bangladesh (Karim *et al.*, 1990). The climate and fertile soils in the coastal zone allow for a wide array of crops to be cultivated, for example, cereals, pulses, vegetables, fruits and cash crops such as jute and sugarcane, (Papademetriou and Dent, 2001). However, the cropping patterns and varieties used are dependent on the local environmental conditions (Allen *et al.*, 1998) most of the farmers follow T-aman –fallow –fallow farming system.

The study area, Patuakhali experiences a humid tropical monsoon climate with moderate rainfall and temperature. The maximum monthly temperature is 25.1° C in January, which rises in the summer to 33.8 ° C in April. The minimum monthly temperatures range from 12.9 ° C in January to 26.7 ° C in July (BMD, 2014). The range of rainfall in the area is about 2580 mm/year. About 90 % of the precipitation occurs in the rainy season from June to September (BBS-SYB, 2011). Relative humidity ranges from a low to about 64 % in March to a high of about 90 % in July. Tropical cyclones usually pass the area during the month from May to November generating tidal bores which cause colossal damage to the area (Sharbari

et al., 2012). Moreover, many other natural phenomena like storm surge, tidal flood, salinity intrusion are also very common in this area (Islam and Uddin , 2015).

Bangladesh is also a country which is very vulnerable to climate change due to its geographic location, altitude, high population density, poor infrastructure, high levels of poverty, absence of technological provisions and high dependency on natural resources (NAPA 2009). Considering the climate change induced risks, Bangladesh's Department of Environment (DoE) estimated potential future sea level rise (SLR) which is 0.30 to 1.5 m for 2050 (DoE, 1993). A rise in sea level of more than 1.0 m would inundate 10% of the country (Barua, Chowdhury and Sarkar, 2010) will result in increasing salinity and sea water intrusion which impacts on crop production. So, it is urgent to assess the climate changes and its impact on agriculture for adaptation or to mitigate climate change effect of agriculture.

RELATED WORK ALREADY PERFORMED :

There is no any literature directly related to the research work. Only a few studies have been conducted in recent years to assess the impact of climate change on agriculture in Bangladesh (Sarker *et al.*, 2012; Amin *et al.*, 2015; Chowdhury and Khan, 2015). Amin *et al.* (2015) reported the significant impact of different climate variables namely, temperature, rainfall, humidity, and sunshine on the yield of major food crops (rice and wheat). Sarker *et al.* (2012) studied the relationships among maximum temperature, minimum temperature, and rainfall with three varieties of rice crops and found a significant impact of climatic variables on the productivity of rice. Hossain *et al.* (2019) revealed that net crop income in Bangladesh is sensitive to climate, particularly to seasonal temperature. A positive effect of temperature rise on net crop income was observed for the farms located in the areas having sufficient irrigation facilities. Amin *et al.* (2015) found that the maximum temperature adversely affected yield and cropping area of all the major food crops and rainfall severely affected Aman rice only. Chowdhury and Khan (2015) revealed that maximum temperature is statistically significant and negatively affect the yield of all rice crops. The influences of maximum temperature and rainfall

are more prominent compared with that of minimum temperature and humidity on rice yield in Bangladesh. Sarker *et al.* (2012) found that the maximum temperature is statistically significant for all rice yields with positive effects on Aus and Aman rice and adverse effects on Boro rice. Minimum temperature has a statistically significant negative effect on Aman rice and a significantly positive effect on Boro rice. Finally, rainfall has a statistically significant effect on Aus and Aman rice. Nonetheless, the influences of maximum temperature and minimum temperature are more pronounced compared with that of rainfall.

RESEARCH OBJECTIVES

1. To study the recent local change of climate in Patuakhali Districts of Bangladesh focusing on temperature, precipitation, humidity and salinity.
2. To identify the impact of climate change on agriculture
3. To identify the impact of climate change on coastal communities and
4. To identify the options to adopt or to mitigate climate change induced problems in T-aman farming system to grow more crops.

METHODOLOGY:

Methodology on the basis of Research questions:

RQ 1: To what extent has the local climate been changed during the last 35 years?

Methods-Step 1: Temperature (maximum and minimum), rainfall, humidity and salinity data for last 35 years (1981 to 2015) from 4 meteorological stations (Barisal, Patuakhali, Khepupara and Bhola) in the southern part of Bangladesh will be collected from Bangladesh Meteorological Department (BMD). The data set will be spatially and statistically analyzed for trend detection and decadal variation at different temporal scales.

Historical data for surface water temperature, salinity and different nutrients of different rivers of Patuakhali and Borguna and the extent of sea water intrusion will be collected from Bangladesh Water Development Board (BWDB), Institute of Water Modelling (IWM), Soil Resource Development Institute (SRDI) and Bangladesh Inland Water Transport Authority (BIWTA). Collected data will be analysed to

explain the existing climate change induced problems of the area. Soil and water samples will be collected from different locations of Patuakhali District. It will be processed and analysed in the Department of Agricultural chemistry and in the central laboratory of PSTU for Salinity and different nutrients to know the present status. We assume that there is a direct relation among the nutrients dynamic and changes of climate that can be represented by a model.

RQ 2: How climate change is affecting the Agriculture?

Methods Step 2: Primary data regarding the total cropped area, area of individual crop cultivated, major and minor crops, changes of cultivated area and its reasons, diversification of crop cultivation and its reasons etc. will be collected using stratified systematic sampling methods. Finally primary data set will be compared with the secondary one to measure the changes over time and the link among the changes of vegetation, climate variables and climate change induced problems. Now a days, it is observed that the cultivation of *rabi* crops (winter crops) is late due to the wetness of field for a long time as a result the farmers of this area don't get their desire return. We assume that if we can establish a relationship (model) among the climate change scenario, planting time and harvesting time etc. then we will be able to give a technology to the farmers by which they will grow more crops.

RQ 3: How climate change is affecting the coastal communities?

Methods Step 3: Household (HH) level semi-structured questionnaire survey, documentary review, key informant interview (KII), and field observations will be employed to conduct the impact study on coastal people. At first the secondary data of the area, population, land use, livelihood, natural disasters, drinking water security/salinity intrusion in the fresh water sources etc. will be collected from Bangladesh Bureau of Statistics (BBS). Primary data of how people are getting affected by the climate change induced problems, at what extent they are suffering and what are the vulnerabilities in the eyes of vulnerable people taking into consideration their own perceived risk factors will be collected by the HH level questionnaire survey. Number of villages and number of HH to be surveyed will be designed based the secondary data as well as the field observations. After reviewing available information, key informants for this study (local administrators,

businessmen, elite people, govt. and non-govt. officials) will be selected keeping in mind to get the highest and diverse level of information on the issue. Finally all data and information will be analyzed to test how climate change is affecting coastal communities.

RQ 4: What type of adaptations/ mitigations measures are required to be acclimatized with the problems?

Methods-Step 4: Adaptation to climate change process requires three steps: climate change impact assessment, selection of promising adaptation options and evaluation of the adaptation options to make definite choices (Ludwig and Swart, 2010). The results of the methods will be used as potential climate change impact assessment on agriculture and local community as they are interrelated and interdependent on each other. Finally the impact study on these components of the ecosystem will be followed by identifying target oriented adaptation options to cope with the climate-change induced problems for the selected coastal areas.

BUDGET

Item	Cost (Taka BDT)
1. Minor equipment :	
a) Portable pH meter	15000
b) Portable EC meter	12000
2. Consumables including chemicals, books, software etc. and sample collection expenses:	
a) Collation and preparation of sample, data collection	100000
b) Chemicals :	69000
c) Stationary purchase	2000
d) Report writing	2000
Total	200000

Total: 2,00000.00/- (Two lacs taka only)

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